

What is claimed is:

[Claim 1] 1. A high voltage device for an electrostatic discharge protection circuit, comprising:

a first type substrate;

a first type epitaxial silicon layer disposed in the first type substrate;

a first type well disposed in the first type epitaxial silicon layer;

a second type well disposed in the first type epitaxial silicon layer, wherein the second type well comprises a second type lightly doped region and a second type heavily doped region, the second type lightly doped region is located next to the first type well and the second heavily doped region is located underneath a portion of the first type well and the second type lightly doped region;

a gate structure disposed on a portion of the first type well and the second type lightly doped region;

a second type first doped region and a second type second doped region disposed in the second type lightly doped region and the first type well on each side of the gate structure respectively;

a first isolation structure disposed in the second type lightly doped region and between the gate structure and the second type first doped region; and

a first type doped region disposed in the first type well and adjacent to the second type second doped region.

[Claim 2] 2. The high voltage device of claim 1, wherein the second type lightly doped region, the first type well and the second type second doped region together constitute a parasitic bipolar transistor, and the second type heavily doped region, the first type well and the second type second doped region together constitute another parasitic bipolar transistor so that a pulse current entering from the second type first doped region is able to channel away through the second type second doped region after passing through the two parasitic bipolar transistors.

[Claim 3] 3. The high voltage device of claim 2, wherein the PN junction between the second type heavily doped region and the first type

well has a smaller breakdown voltage than the PN junction between the second type lightly doped region and the first type well, and the breakdown voltage of the PN junction between the second type heavily doped region and the first type well is the breakdown voltage of the electrostatic discharge protection circuit.

[Claim 4] 4. The high voltage device of claim 1, further comprises a second isolation structure disposed in the first type well and between the first type doped region and the second type second doped region.

[Claim 5] 5. The high voltage device of claim 4, wherein the second isolation structure comprises a field oxide isolation structure or a shallow trench isolation (STI) structure.

[Claim 6] 6. The high voltage device of claim 1, wherein the first isolation structure comprises a field oxide isolation structure or a shallow trench (STI) structure.

[Claim 7] 7. The high voltage device of claim 1, wherein the second type first doped region, the second type lightly doped region and the second type heavily doped region together serves as a drain and the second type second doped region serves as a source.

[Claim 8] 8. The high voltage device of claim 1, wherein the second type lightly doped region comprises a high voltage second type well.

[Claim 9] 9. The high voltage device of claim 1, wherein the second type heavily doped region comprises a second type buried layer.

[Claim 10] 10. The high voltage device of claim 1, wherein first type is a P-type and the second type is an N-type.

[Claim 11] 11. A high voltage device, comprising:

a first type substrate;

a first type epitaxial silicon layer disposed in the first type substrate;

a first type well disposed in the first type epitaxial silicon layer;

a second type well disposed in the first type epitaxial silicon layer, wherein the second type well comprises a second type lightly doped region and a second type heavily doped region, the second type lightly doped region is located next to the first type well and the second heavily doped region is located underneath a portion of the first type well and the second type lightly doped region;

a gate structure disposed on a portion of the first type well and the second type lightly doped region;

a second type first doped region and a second type second doped region disposed in the second type lightly doped region and the first type well on each side of the gate structure respectively;

a first isolation structure disposed in the second type lightly doped region and between the gate structure and the second type first doped region; and

a first type doped region disposed in the first type well and adjacent to the second type second doped region.

[Claim 12] 12. The high voltage device of claim 11, further comprises a second isolation structure disposed in the first type well and between the first type doped region and the second type second doped region.

[Claim 13] 13. The high voltage device of claim 12, wherein the second isolation structure comprises a field oxide isolation structure or a shallow trench isolation (STI) structure.

[Claim 14] 14. The high voltage device of claim 11, wherein the first isolation structure comprises a field oxide isolation structure or a shallow trench (STI) structure.

[Claim 15] 15. The high voltage device of claim 11, wherein the high voltage device has a variety of applications in the design of circuits.

[Claim 16] 16. The high voltage device of claim 15, wherein the high voltage device is used inside display driver ICs, power supplies, power administrators, telecommunications, automobile electronics and industrial controls.

[Claim 17] 17. The high voltage device of claim 11, wherein the second type first doped region, the second type lightly doped region and the second type heavily doped region together serves as a drain and the second type second doped region serves as a source.

[Claim 18] 18. The high voltage device of claim 11, wherein the second type lightly doped region comprises a high voltage second type well.

[Claim 19] 19. The high voltage device of claim 11, wherein the second type heavily doped region comprises a second type buried layer.

[Claim 20] 20. The high voltage device of claim 11, wherein first type is a P-type and the second type is an N-type.